

maximum velocities of fifty miles or more per hour occurred on the following dates: 1st, 2d, 3d, 4th, 5th, 6th, 7th, 8th, 13th, 14th, 20th, 21st, 22d, 23d, 24th, 26th, 27th. The highest velocities recorded were as follows: 72, nw., 4th; 80, nw., 5th; 94, nw., 6th (maximum for month); 80, nw., 21st; 72, nw., 22d; 76 nw., 24th; 76, nw., 26th; 76, nw., 27th.

On the summit of Pike's Peak, Colorado, the highest velocity recorded was 48, w., 17th.

Other stations reporting velocities of forty miles or more per hour, are as follows: Sandy Hook, New Jersey, 55, e., 2d; Fort Assiniboine, Montana, 52, sw., 16th, and 43, w., 20th; Fort Bennett, Dakota, 51, nw., 16th; Block Island, Rhode Island, 47, ne., 29th; Cape May, New Jersey, 47, nw., 2d; New York City, 45, e., 2d; North Platte, Nebraska, 44, e., 10th; Indianola, Texas, 43, ne., 17th; Barnegat City, New Jersey, 40, n., 2d; Delaware Breakwater, Delaware, 40, s., 2d; Fort Benton, Montana, 40, s., 26th.

LOCAL STORMS.

Galveston, Texas.—A despatch from Midlothian, Ellis county, on the 3d, stated that a violent wind and rain storm occurred there on the evening of that date, during which a hotel and livery stable were blown down, and the contents of a lumber yard were scattered great distances over the prairie. The hotel was completely destroyed, and several persons were buried beneath the ruins.

Paris, Bourbon county, Kentucky.—The heavy rain and wind storm of the 10th caused considerable damage to the crops in this locality.

Wall Lake, Sac county, Iowa.—The storm on the night of the 7-8th was the severest that has been experienced in this county during the present year. The wind blew with great force, and was accompanied by a heavy fall of rain and hail. Bridges were washed out in various parts of the county, and the creeks and streams rose to unusual heights. Damage to the extent of thousands of dollars was done to the crops and other property in this county. A large quantity of window-glass was broken, and small animals and poultry were killed, by the hail. In some localities the grain was so completely destroyed that no attempt will be made to harvest it.

Des Moines, Iowa.—During the night of the 7-8th a hail storm of great severity passed through the valley of the Nishnebotene river, along the Audubon branch of the Chicago, Rock Island & Pacific railroad. All crops in the path of the storm, which was about four miles wide, were almost completely destroyed. Several houses were blown down, and a number of cars were lifted from the track. At Gray, Audubon county, it is reported that the hail covered the fence tops, and the trains were delayed until the hail was cleared from the track. Twenty-one of a herd of cattle were killed near Gray, where hailstones were found that measured thirteen inches in circumference. Seven miles north of Audubon, a dwelling was blown down, killing one of the inmates. The approach of the storm was preceded by a deafening roar.

Mr. F. W. Bowen, a volunteer observer of the Signal Service, at Humboldt, Iowa, reports that a remarkable hail storm occurred in Sac county, in that state, on the 8th. The hailstones were unusually large, and covered the ground to a great depth. Two days after the storm there remained, in places, large quantities of the unmelted hailstones.

Chattanooga, Tennessee.—On the afternoon of the 15th a destructive local storm passed over this city. There were two distinct tornado formations—one coming from the northwest, and the other from the northeast, uniting over the East Tennessee railroad depot, and afterwards continued its course for a distance of about one-half mile. The full force of the storm was of about four minutes' duration, from 5.18 to 5.22 p. m. Before uniting, the length of the tracks was about one and one-half miles, and its average width was two hundred yards. Hail fell during the storm, some of the hailstones measuring three-fourths of an inch in diameter. The damage to property was comparatively small, and is estimated at \$3,000.

Galveston, Texas.—A despatch, dated August 18th, from Waco, McLennan county, states that on the afternoon of the 16th a tornado struck the village of Oglesby, destroying the station house and a store, and scattering their contents over the prairie.

Duluth, Minnesota.—The high northwesterly winds of the 19th and 20th caused considerable damage at Agate Bay. Several small boats were driven ashore, and a scow laden with lumber was completely wrecked, and the lumber lost.

Toronto, Ontario.—A severe storm visited northwestern Ontario on the 19th. At Listowell the streets were covered with water to a depth of two feet. Several buildings and bridges were washed away and other property destroyed. At Wingham the river rose twelve feet, and a bridge and the railroad track at that place were washed away. Large quantities of standing grain were destroyed.

Winnipeg, Manitoba.—A severe storm visited this region on the 20th. A number of buildings in the suburbs were blown down, and several in the city were damaged.

At about 6 p. m., of the 21st, the town of Rochester, Minnesota, was visited by a most violent and destructive tornado, which destroyed a large part of the town. Throughout the day the weather had been unsettled, but it was not unusually threatening. At 3 p. m. a dark cloud arose in the west, which passed over, accompanied by high wind and a slight fall of rain. At 5 p. m. a low bank of cloud was observed in the southwest, which rose rapidly, but it presented only the appearance of an ordinary thunder-cloud. As it neared the city it assumed a threatening appearance, the whole sky becoming tinged with green. In the upper part of the city the darkness was not great, but in the lower part it became as dark as night. The approach of the tornado cloud was preceded by the usual roaring sound, which served as a warning to many persons, who sought protection in the cellars of the houses and escaped without injury. In Rochester one hundred and thirty-five dwellings were completely destroyed, together with their contents, and a large number of others were unroofed or otherwise damaged. Thirty-one persons were killed and about one hundred were more or less seriously injured. A train on the Rochester and Northern division of the Chicago & Northwestern railroad, while running at a high rate of speed, was blown from the track and wrecked between Rochester and Zumbrota, Minnesota. A number of the passengers were killed, and nearly every one on the train sustained bodily injury. The path of the tornado was from west to east, and its length was about eighteen miles. A relief committee was organized, and issued circulars appealing for contributions for the aid of the sufferers. The committee, after having examined the condition of fifty farms in the track of the storm, reported that every house and barn on them was demolished, and that much valuable stock was killed, farming implements wrecked, and thousands of bushels of grain were destroyed. The loss to the farmers in Olmstead county is estimated to be not less than \$200,000.

Swanwick, Perry county, Illinois.—A violent thunder-storm, coming from a northwesterly direction, occurred here on the 22d, during which the lightning struck numerous objects and caused considerable damage.

Marquette, Michigan.—Several roofs, chimneys, signs, and fences in this city were blown down during the storm of the 22d. Vessels report the storm to have been very severe on Lake Huron on that date.

Ottawa, Ontario.—A storm swept over this vicinity during the night of the 22-23d, which caused serious damage to buildings and crops.

NAVIGATION.

STAGE OF WATER IN RIVERS.

No high stages of water occurred in any of the rivers during the month.

At the most northerly stations on the Mississippi river the highest water was observed on the 1st, and also at Vicksburg, Mississippi, and New Orleans, Louisiana, on that date. The

lowest stages in the Mississippi were recorded on the 31st at Saint Louis, Missouri, and at stations southward; and between the 22d and 31st at stations north of Keokuk, Iowa. The observer at Saint Paul, Minnesota, states that, owing to the low stage of water in the upper Mississippi river during the month, it has been necessary that steamers should take barges in tow to serve as lighters.

The Missouri was highest at Yankton, Dakota, from the 1st to 4th; at Omaha, Nebraska, on the 2d; and at Leavenworth, Kansas, on the 20th. It was lowest at these stations from the 29th to 31st.

The Ohio river reached its highest stage from Cincinnati, Ohio, to Louisville, Kentucky, on the 4th and 5th; it was lowest at Cincinnati on the 20th, and at Louisville on the 27th.

Navigation in the Tennessee river at Chattanooga, Tennessee, except for small craft, was suspended on the 2d.

The highest and lowest stages of water observed at the Signal Service stations during August, 1883, are shown in the following table:

Heights of rivers above low-water mark, August, 1883.

Stations.	Danger-point on gauge.	Highest water.		Lowest water.	
		Date.	Height.	Date.	Height.
<i>Red River:</i>	<i>Ft. In.</i>		<i>Ft. In.</i>		<i>Ft. In.</i>
Shreveport, La.....	29 9	1, 2, 17	8 10	10	5 9
<i>Arkansas:</i>					
Little Rock, Ark.....		11	4 9	3	2 7
Fort Smith, Ark.....					
<i>Missouri:</i>					
Yankton, Dakota.....	20 0	1 to 4	3 6	29, 30, 31	2 1
Omaha, Nebr.....	16 0	2	9 5	31	7 4
Leavenworth, Kans.....	21 0	20	12 1	29, 30, 31	9 3
<i>Mississippi:</i>					
Saint Paul, Minn.....	14 6	1	3 6	26	1 8
La Crosse, Wis.....	18 0	1	4 10	31	1 11
Dubuque, Iowa.....	21 10	1	11 9	22	4 3
Davenport, Iowa.....	15 0	1	9 8	27	2 11
Keokuk, Iowa.....	14 6	3, 4	10 11	28, 29, 30	4 3
Saint Louis, Mo.....	30 0	3	21 3	31	11 4
Calto, Ill.....	40 0	5	21 8	31	11 0
Memphis, Tenn.....	34 0	7, 8	16 1	31	8 6
Vicksburg, Miss.....	41 0	1	30 3	31	14 2
New Orleans, La.†.....	—2 6	1, 2	—3 9	31	—11 2
<i>Ohio:</i>					
Pittsburg, Pa.....	20 0	1	6 3	28	0 7
Cincinnati, Ohio.....	50 0	4	16 0	20	4 10
Louisville, Ky.....	24 0	5	7 11	27	4 0
<i>Cumberland:</i>					
Nashville, Tenn.....	42 0	3	10 1	31	1 9
<i>Tennessee:</i>					
Chattanooga, Tenn.....	33 0	19	2 7	13	1 2
<i>Monongahela:</i>					
Pittsburg, Pa.....	29 0	1	6 3	28	0 7
<i>Savannah:</i>					
Augusta, Ga.....	30 0	28	7 0	12	4 1
<i>Willamette:</i>					
Portland, Oreg.....		1	7 3	31	4 0
<i>Sacramento:</i>					
Red Bluff, Cal.....		1, 2, 3	0 7	4 to 31	0 6
Sacramento, Cal.....		1	7 9	31	6 9
<i>Mobile:</i>					
Mobile, Ala.....		1, 29	17 3	24	15 3
<i>Colorado:</i>					
Yuma, Arizona.....		6	19 9	31	16 8

* Below bench-mark. † Below high-water marks of 1874 and 1883.

HIGH TIDES.

Atlantic City, New Jersey.—Much damage was done at this place by the high tide of the 29th, which reached its highest point at 5.30 a. m. About two hundred and fifty places of business, including about twenty of the finest bathing houses, were washed away. The track of the Camden & Atlantic railroad, from this place to South Atlantic City, was covered with water, and it was reported that the meadows, three miles beyond the city, were totally inundated. Thousands of dollars worth of bathing suits were lost, and all kinds of business interests suffered serious loss. All of the railroad tracks between Atlantic City and Absecon, with the exception of the West Jersey railroad, were submerged and tracks injured. It is considered that \$250,000 will not replace the property destroyed.

Seabright, New Jersey, 29th.—The high tide of this date caused a washout, of one-fourth mile in length, on the New Jersey Southern railroad, at Highland station, between this place and Sandy Hook. In some places the track was covered with more than two feet of sand, which caused serious inter-

ruption to travel. A large number of drowned cattle floated ashore between this and Highland station, which are supposed to have been washed or thrown overboard from ocean steamers.

Long Branch, New Jersey, 29th.—The beach at this place was badly washed by the high tide of this date. During the afternoon the water began running over the New Jersey railroad, opposite the highlands of Navesink. The track was undermined in several places, and at some points it was covered with nearly three feet of sand.

Newport, Rhode Island, 29th.—The heavy sea and high tide of this date washed away the platform leading from the road to the beach. The high sea prevented the steamers plying between this place and Block Island and Narragansett Pier from making their regular trips.

Ocean City, Maryland, 29th.—High tide flooding Atlantic and Wicomico avenues, and washing away a portion of the railroad bed near the station.

Boston, Massachusetts, 29th.—Very high tide and rough sea in the harbor on this date.

Block Island, Rhode Island, 12th; and unusually high on the 29th.

Portsmouth, North Carolina, 21st, 27th.

Wash Woods, North Carolina, 29th, 30th, 31st.

LOW TIDES.

Cedar Keys, Florida, 16th.

Indianola, Texas, 7th.

VERIFICATIONS.

INDICATIONS.

The detailed comparison of the tri-daily indications for August, 1883, with the telegraphic reports for the succeeding twenty-four hours, shows the general average percentage of verifications to be 86.95 per cent. The percentages for the four elements are: weather, 87.63; direction of the wind, 81.74; temperature, 89.41; barometer, 87.89 per cent. By geographical districts they are: For New England, 88.04; middle Atlantic states, 91.08; south Atlantic states, 84.50; eastern Gulf, 86.49; western Gulf, 90.66; lower lakes, 88.31; upper lakes, 85.27; Ohio valley and Tennessee, 88.95; upper Mississippi valley, 83.94; Missouri valley, 81.42; north Pacific, 100.0; middle Pacific, 100.0; south Pacific, 97.91.

There were seventy-nine omissions to predict out of 3,813, or 2.07 per cent. Of the 3,734 predictions that have been made, sixty-seven, or 1.79 per cent., are considered to have entirely failed; ninety-five or 2.54 per cent. were one-fourth verified; four hundred and thirty-three or 11.60 per cent. were one-half verified; five hundred and thirty, or 14.20 per cent., were three-fourths verified; 2,609, or 69.87 per cent., were fully verified, so far as can be ascertained from the tri-daily reports.

CAUTIONARY SIGNALS.

During August, 1883, one hundred and nineteen cautionary signals were displayed. Of these, eighty-nine, or 74.79 per cent., were justified by winds of twenty-five miles or more, per hour, at or within one hundred miles of the station. One cautionary off-shore signal was displayed, which was justified both as to direction and velocity. Seven cautionary signals were changed to northwest signals. One hundred and twenty signals, of all kinds, were displayed, of which ninety, or 75.0 per cent., were fully justified. These do not include signals ordered at display stations where the velocity of the wind is only estimated. Nine signals were ordered late.

Eighty-six winds of twenty-five miles, or more, per hour were reported, for which no signals were ordered. Many of these were high local winds or strong sea-breezes.

TEMPERATURE OF WATER.

The temperature of water, as observed in rivers and harbors at the Signal Service stations, during August, 1883, with the average depth at which the observations were made, are given in the table below. The highest water temperature recorded during the month, 92° 2, occurred at Cedar Keys, Florida; and